

New structure for definition of Reference Frames

A new SIDS type, **ReferenceFrame_t**, is proposed to define a local coordinate system, it is always defined with N cartesian axis for a N physical dimension. If a Parent is specified, then the frame is relative to this parent, without a parent the frame is global. It is expected that all values that would use a reference frame (i.e. grid coordinates, velocities, ...) and that are located as a child or a brother of the *ReferenceFrame_t* node, are given with respect to their associated *ReferenceFrame_t*. A reference frame can be defined as a child of a node already having a reference frame. In that case, this new reference frame is used instead of the ancestor one. No motion is associated to frame, but motion would have a frame. The type has the following pattern:

```
CoordinateSystemType_t := Enumeration (
  Null,
  Cartesian,
  Spherical,
  Cylindrical,
  Auxilary,
  UserDefined );

ReferenceFrame_t<int CellDimension> := {
  List ( Descriptor_t Descriptor1 ... DescriptorN );           (o)
  DataArray_t<real,1,PhysicalDimension> CoordinateOrigin;    (r)
  DataArray_t<real,1,PhysicalDimension> AxisX;                (1)
  DataArray_t<real,1,PhysicalDimension> AxisY;                (1)
  DataArray_t<real,1,PhysicalDimension> AxisZ;                (1)
  DataArray_t<real,1,PhysicalDimension> AxisR;                (1)
  DataArray_t<real,1,PhysicalDimension> AxisTheta;           (1)
  DataArray_t<real,1,PhysicalDimension> AxisPhi;              (1)
  DataArray_t<char, 1, MaxPathLength> ParentFrame;           (o)
  List ( UserDefinedData_t UserDefinedData1 ... UserDefinedDataN ); (o)
};
```

(1): Required information for SIDS compliant structure:

| System | Cartesian | Cylindrical | Spherical |
|--|---------------------------|---------------------------|---------------------------|
| Mandatory | CoordinateOrigin AxisX | CoordinateOrigin AxisR | CoordinateOrigin AxisR |
| Optional (depends on physical dimension) | AxisY AxisZ | AxisTheta AxisZ | AxisTheta AxisPhi |
| Optional | ParentFrame | ParentFrame | ParentFrame |

The ReferenceFrame_t pattern requirements are:

1. The name of a ReferenceFrame_t is ReferenceFrame.
2. The actual mandatory nodes depend either on the CoordinateSystem and the Physical dimensions of the CGNSBase.
3. There is no mandatory location.
4. The optional locations are CGNSBase_t, Zone_t, RigidGridMotion_t, FlowSolution_t, BC_t, BCDataSet_t, UserDefinedData_t, GridCoordinates_t.
5. ParentReferenceFrame: is an absolute path of the parent ReferenceFrame_t node (optional). The path is relative to the current node and contains the node name itself. The path of the current frame in itself is ../ReferenceFrame
6. CoordinateOrigin is the origin point coordinates in the parent coordinate system or in the absolute frame if no parent frame is defined.
7. Axis*: coordinates of the * vector in the parent coordinate system
8. MaxPathLength is a system constant that is set to 256.
9. In the case a ParentFrame is not defined, the global frame is used as parent frame.